Mapping of properties for optical appearance of anodized aluminum

Johansen, Villads Egede; Jensen, Flemming ; Aggerbeck, Martin; Gudla, Visweswara Chakravarthy

Publication date:
2014

Mapping of properties for optical appearance of anodized aluminum

Villads Egede Johansen[a,c], *Flemming Jensen*[b], *Martin Aggerbeck*[a], *Visweswara Chakravarthy Gudla*[a]

[a]Department of Mechanical Engineering, Technical University of Denmark, Nils Koppels Allé 404, 2800 Kongens Lyngby, Denmark

[b]Bang og Olufsen, Peter Bangs Vej 15, 7600 Struer, Danmark

[c] vejo@mek.dtu.dk

Visual appearance of anodized aluminium is an important parameter in many product designs, and even though the appearance of anodized aluminium is well known, the actual effect of alloy, surface finish and anodizing conditions are not fully understood. Furthermore, appearance is hard to quantify and is affected by lighting conditions, observer position and surroundings.
In this work, a set of basic parameters for characterization of visual appearance of anodized aluminum have been identified, enabling comparison of the appearance of various specimens and treatments. To be able to do this we have taken outset in models of the physics based on Maxwell's equations and also looked into how appearance properties are reduced to few effective parameters in computer graphics research (see e.g. [1]).
To test the appearance model a set of samples with difference in anodized surface appearance were produced (see for example figure 1). These samples were made from sheet material of Peraluman 853 and 2024 as well as extruded 6060 Al alloys. Afterwards, the samples were either mechanical polished or caustic etched before anodizing for different thicknesses and using different voltages. This have given a wide range of samples for comparison.
From the experiments, the proposed appearance model was developed and verified by fitting the model to the data, and identifying which parameters had influence on the appearance. The results were used to classify the substrates by their visual appearance and to propose optimal anodization parameters for a desired visual appearance.

References

[1] Xiao D. He, Kenneth E. Torrance, François X. Sillion, and Donald P. Greenberg. A comprehensive physical model for light reflection. *ACM SIGGRAPH Computer Graphics*, 25(4):175–186, July 1991.

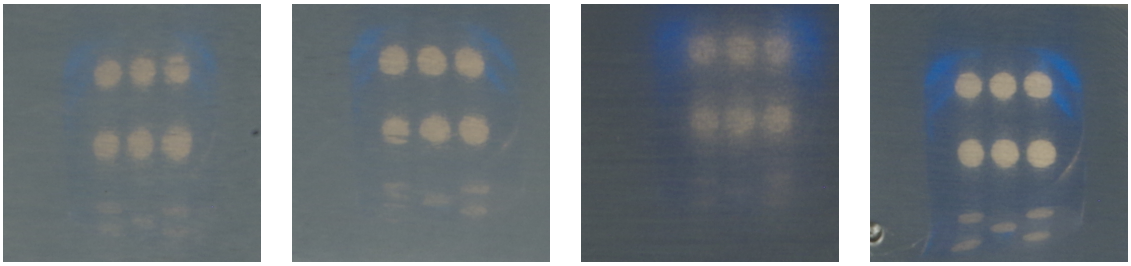

Figure 1: Reflection of a blue plastic die reflected on different polished, anodized aluminium substrates.